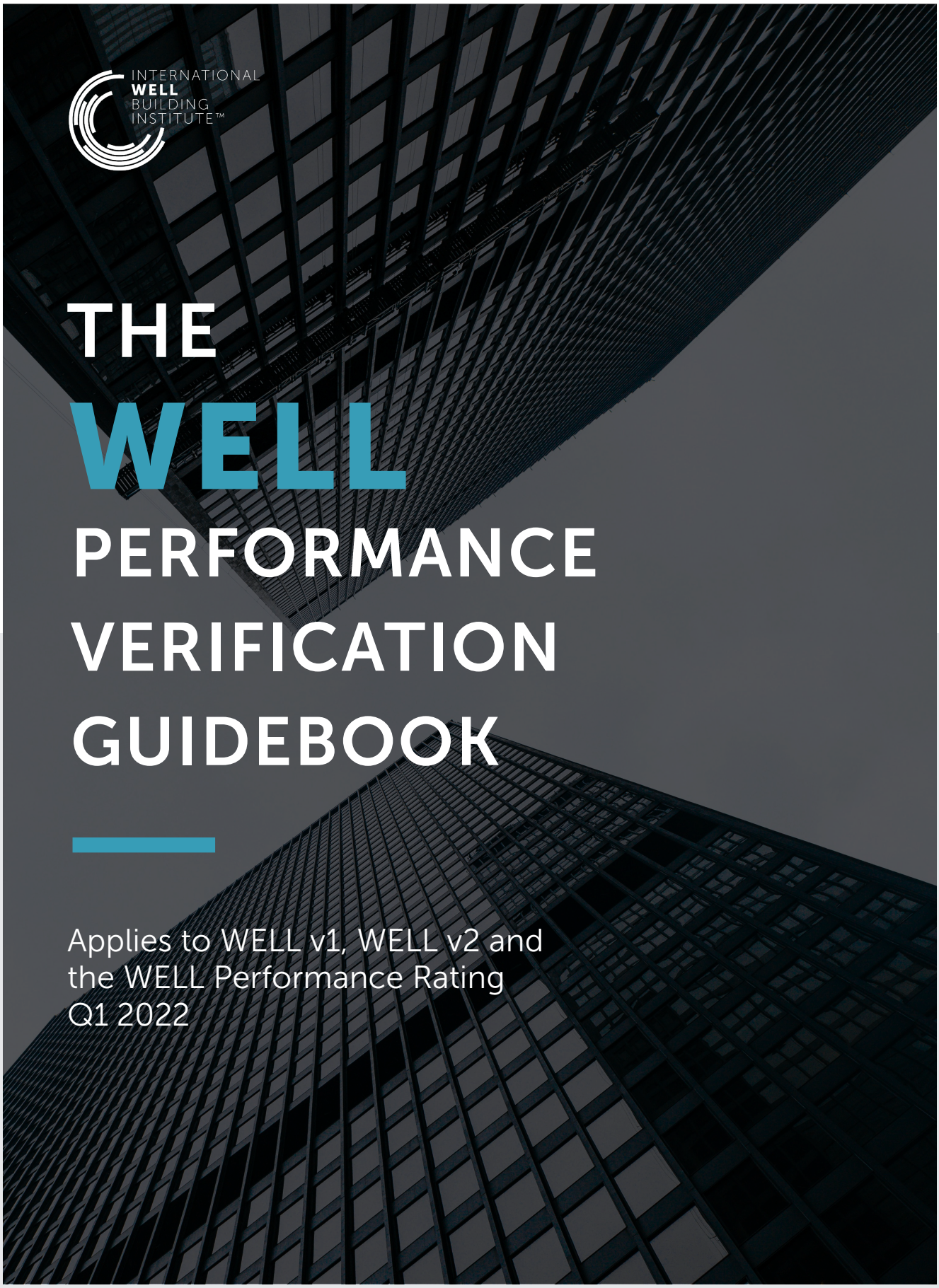

THE WELL PERFORMANCE VERIFICATION GUIDEBOOK

Applies to WELL v1, WELL v2 and the WELL Performance Rating
Q1 2022

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Introduction

The WELL Performance Verification Guidebook contains details regarding the Performance Verification phase of WELL. The processes described apply to the WELL Building Standard version 1 (WELL v1), including WELL Core & Shell and WELL v1 pilots, the WELL Building Standard version 2 (WELL v2) and WELL v2 pilot, including WELL Core, and the WELL Performance Rating.

For more information on WELL Certification and the steps involved in scheduling WELL performance testing, refer to the complete WELL Certification Guidebook.

Performance Verification

Performance Verification entails collecting on-site measurements, either through a site visit by a WELL Performance Testing Agent who conducts performance tests or through permanently installed continuous monitors, followed by a Performance Review by a WELL Reviewer assigned by IWBI. Collecting on-site measurement data is a requirement for WELL Certification and the WELL Performance Rating and the results of the data collected for each applicable feature are reviewed by the WELL Reviewer to determine whether a feature has been achieved.

Purpose of this Guidebook

This guidebook dictates the performance testing protocol for each feature that has *Performance Test* or *Sensor Data* included as a part of the verification method.

WELL Performance Testing Agents are required to ensure that the performance testing activities executed for a given project are conducted in accordance with the instructions and requirements specified in this guidebook. These pathways may also be project teams wishing to engage in their own pre-testing of WELL requirements prior to initiating Performance Verification. Note that the results of any pre-testing do not affect the outcome of performance testing executed by the WELL Performance Testing Agent for the purposes of WELL Certification.

Continuous monitoring and sensing technologies can be utilized to meet the requirements of select performance verified features and parts within the WELL Building Standard version 2 (WELL v2) and WELL Ratings. The *Performance Testing Protocols for WELL* Section of this guidebook provides information on the technical specifications and placement requirements for each feature and part that incorporates continuous monitoring and sensing pathways as part of the verification method.

For features noted as verified by a Performance Test that may have a sensor-based measurement pathway, project teams are encouraged to submit an Alternative Adherence Path (AAP) explaining the process and demonstrating consistent, accurate results prior to test result submission.

WELL Performance Testing Agent

During the site visit, the WELL Performance Testing Agent will follow the testing protocol contained in this guidebook. The WELL Performance Testing Agent will ensure that the data

collected during performance testing accurately represents the environmental and design conditions in the project at that time.

The WELL Performance Testing Agent is not permitted to interfere, manipulate or alter site conditions in any way that might affect WELL Certification. Data collected on-site by the WELL Performance Testing Agent must be analyzed and the results must be reviewed by the WELL Reviewer before feature compliance can be determined; therefore, the WELL Performance Testing Agent cannot provide information regarding feature compliance while on site.

General Information and Set-Up

For purposes of certification, performance testing must take place after construction is complete and, for projects seeking WELL Certification, after the project has successfully passed Documentation Review. Core and Shell and WELL Core projects may undertake performance testing prior to their tenants' construction completion; however, this may negatively affect results from the on-site tests. Project conditions during performance testing should be representative of those normally experienced by occupants unless otherwise noted within this document.

Scope

Table 1 sets forth the performance testing scope that is applicable for each WELL project type. For each project type, all areas described in the table below are subject to performance testing and visual inspections or photographs and must be considered by the WELL Performance Testing Agent when choosing sampling zones and sampling points. If the project is made up of multiple distinct structures, each parameter must be tested at least once in each structure, even if that results in more than the number of samples listed in this document.

Table 1: Scope of Performance Testing Activities

WELL PROJECT TYPE	PERFORMANCE TESTING SCOPE
WELL v1 • New and Existing Buildings • New and Existing Interiors • Educational Facilities, Commercial Kitchens, Retail, and Restaurants Pilots **WELL v2 and WELL v2 pilot** • All project types except WELL Core	The entire area within the WELL project boundary, including any mechanical spaces and/or water fixtures servicing the project.
WELL v1 • Core & Shell **WELL v2, WELL v2 pilot, and the WELL Performance Rating** • WELL Core	Non-leased spaces, including the common areas of the building and private spaces directly under the control of the building management team, provided this makes up at least 2.5% of the total project area. Otherwise, the areas listed above plus enough tenant space to sum to at least 2.5% of the total project area. Note: Some performance-based optimizations explicitly require testing in tenant spaces for achievement.
WELL v1, WELL v2 pilot (except for WELL Core), WELL v2, and the WELL Performance Rating • Multifamily Residential	For initial certification, the entire area within the WELL project boundary, including inside the dwelling units. For subsequent recertification, only the spaces directly under the control of the building management team (e.g., common areas).

Sampling Point Selection

The WELL Performance Testing Agent will select sample points for each performance test ahead of arriving on site. Upon arriving on-site, the WELL Performance Testing Agent will perform a walkthrough of the areas subject to performance testing and familiarize themselves with the building floor plan. In order to ensure access to all sampling areas, the WELL Performance Testing Agent should be guided by an individual from the building management team who is familiar with the space. After this walkthrough, the WELL Performance Testing Agent may make adjustments to the selected sampling locations after observing actual site conditions to comply with testing protocol. For example, the WELL Performance Testing Agent may move a sampling point from an area of low occupancy to an area of typical occupancy.

Whenever a calculation results in a fractional sampling point, round up to the next whole number, unless otherwise indicated. Additionally, please note that the number of sampling locations represents a minimum. The WELL Performance Testing Agent may include additional sampling points.

Multifamily Residential

For sample point selection of multi-family residential projects, the project team must indicate how many different unit types there are based on the following criteria. Every dwelling unit of each unit type must:

- Be under the same ownership and management
- Be part of the same construction contract
- Use the same heating and ventilation methods
- Use the same building materials, finishes and furnishings throughout

Each unit of a given unit type may differ in layout and size (e.g., number of bedrooms, window placements, ceiling heights, difference in area, etc.)

Equipment and Laboratories

In all cases, the equipment used must be maintained and calibrated according to the manufacturer's specifications and instructions from the manufacturer must be followed when taking measurements. Any applicable laboratory analyses must be performed in a third-party laboratory that is accredited by an agency recognized by the International Laboratory Accreditation Cooperative (ILAC) or is accredited to meet ISO 17025-2017 by an accreditation body authorized by the local government, and that has no financial or other interest in the outcome of WELL Certification or Performance Verification. Laboratory samples must be collected, packaged and analyzed in accordance with instructions provided by the third-party laboratory.

WELL Performance Testing Agents must be aware of restrictions on laboratory operations and transportation and how this affects scheduling performance tests. For example, water samples for coliform analysis are often not permitted to be shipped on a Friday due to the risk of delays in custody transfer and degradation of samples in storage.

Compliance with Instructions and Protocols

WELL Performance Testing Agents are required to ensure that performance testing is conducted in accordance with the instructions and requirements specified in this guidebook. If, due to site conditions or other factors beyond the WELL Performance Testing Agent's control, it is necessary to deviate from the protocols described in this guidebook during performance testing, the WELL Performance Testing Agent must note and provide an explanation for the deviation in performance testing documentation and/or final report.

To demonstrate compliance, the WELL Performance Testing Agent must submit full data of all tests taken on-site in addition to the summarized value used for comparison of compliance. In addition, the agent must provide:

- List and specs of equipment used to confirm that it meets the requirements described in this guidebook.

- Certificates of calibration for the equipment used confirming that all equipment is properly calibrated.
- Floor plans showing the locations of the sample points along with the date and time each sample is collected.
- Photographs of representative sample locations including, when possible, photographs of the actual measurement device.

Measurement Tolerance

For projects registered under WELL v2 or WELL v2 pilot, several on-site performance testing parameters include a tolerance that is added to the requirement's threshold. For example, for $PM_{2.5}$, compliance is based on the requirement in WELL + a tolerance of 20%. Thus, since the threshold is a maximum of 15 $\mu g/m^3$, the acceptable threshold for $PM_{2.5}$ is 18 $\mu g/m^3$ or lower). These tolerances are not applicable to projects registered under WELL v1. Pathways using permanently installed continuous monitors use their own compliance calculations, and do not include tolerances.

Performance Testing Protocols for WELL

Air

General Guidelines

Unless otherwise noted, these rules apply to all parameters within the Air concept.

Test Locations & Conditions

- Testing should be conducted under regular project conditions. For example, for naturally ventilated spaces, the windows should be open during testing.
- The WELL Performance Testing Agent should note whether the HVAC system (or any ventilation or air treatment method) is on or off during the data collection period.
- Sampling points must be representative of typical occupiable areas within the sampling zone and located where occupants would typically be situated (e.g., at workstations).
- Sampling points must be at a height of 1.1-1.7 m [3.6-5.6] ft above the finished floor.
- Sampling points must be at least 1 m [3.3 ft] away from walls, doors, windows, air supply/exhaust outlets and any occupants that are present during testing. To the extent possible, sampling points should be at least 5 m [16.4 ft] from exterior doors.
- For projects with multiple floors, measurements must be distributed across different floors, including the lowest and highest regularly occupied floor (excluding floors with only leased space in WELL Core and Core & Shell).
- For WELL v2 and WELL v2 pilot projects, where sampling points for A01 and A05 are the same, tests used for A01 can be analyzed to determine whether results meet A05 requirements (i.e., separate tests are not required for A05 if all necessary parameters are available from samples taken for A01). This also applies to the "Enhanced thresholds" features in the WELL Performance Rating (PA2, PA4, PA6).

Test Quantity

Table 2: Number of Sampling Points Required Based on Project Area and Number of Floors

Floors	TOTAL PROJECT AREA*	
	<50,000 ft² <4,600 m²	≥50,000 ft² ≥4,600 m²
1	2	3
2	2	4
3-4	3	5
5-7	3	6
8-10	4	7
11-15	5	8
16-20	6	9
>20	7	10

*For Core & Shell and WELL Core projects, to determine the number of sampling points:

- For WELL v2 and WELL v2 pilot Feature A01 and WELL v1 Feature 01 (preconditions), use the project's total non-leased area for the purpose of project area in this table.

Testing in the leased area is not required unless the non-leased area does not make up the minimum required testable area.

- For WELL v2 and WELL v2 pilot Feature A05 (optimization), use the project's total area. In addition to testing in non-leased areas, the WELL Performance Testing Agent must have access to test within tenant spaces (either before or after fit-out), representing at least 10% of the leased area.
- For Multifamily Residential projects, unless otherwise stated, sample points should be taken as follows:
    - Projects with 10 dwelling units or fewer: two of each unit type
    - Projects with more than 10 dwelling units: 5% of each unit type, with a minimum of three and a maximum of 10 units of each unit type
- To determine the test quantity for all other non-dwelling spaces, follow Table 2 sampling point guidance for the total area of regularly occupied spaces only, not the total project area (e.g., occupied lobbies and gyms are considered regularly occupied spaces and therefore would be included in the Table 2 calculations; common areas such as hallways are not considered regularly occupied spaces and therefore would not be included in the calculations).

$PM_{2.5}$ and PM_{10}

Features

- WELL v1: Feature 01, Part 2
- WELL v2 and WELL v2 pilot: Features A01, Part 1; A05, Part 1
- WELL Performance Rating: PA1, PA2, PM1

Test Locations & Conditions

- See *General Guidelines*.

Test Method

- Measurement method: direct reading instrument.
- Duration of measurement: minimum of one continuous hour (10 minutes of acclimation time followed by 50 minutes of measurement time), with measurements recorded at least once every minute.

Test Quantity

- See Table 2 in *General Guidelines*.

Reporting & Compliance

- Compliance is based on the median value collected during the measurement time at each sampling point compared against the requirement in WELL + a tolerance of 20%.

Device Requirements

- Instrument type: light-scattering airborne particle counter
- Measurement range: 1-1,000 $\mu g/m^3$
- Instrument accuracy (at the size specified by the manufacturer): $\leq$ 15%
- On-screen resolution: 1 $\mu g/m^3$
- Lower detectable limit: 1 $\mu g/m^3$

- Reporting interval: one-minute maximum
- Calibration: instrument must be calibrated within the manufacturer's specification (maximum interval: one year), and the calibration record (i.e., the measurement result obtained during calibration) must be traceable to a National Metrological Institute, such as NIST, NPL or PTB.

Formaldehyde and Acetaldehyde

Features (formaldehyde)

- WELL v1: Feature 1, Part 1
- WELL v2 and WELL v2 pilot: Features A01, Part 2; A05, Part 2
- WELL Performance Rating: PA3, PA4, PM1

Features (acetaldehyde)

- WELL v2: Feature A05, Part 2
- WELL Performance Rating: PA4

Test Locations & Conditions

- See *General Guidelines*.

Test Method

- Samples are taken through an active collection in accordance with ISO 16000-3, ASTM D5197, NIOSH 2016, EPA TO-11 (or 11A) or EPA Compendium Method IP-6 (or 6A).
- Minimum of one continuous hour OR the duration of sampling volume prescribed by the referenced testing methodology.
- A minimum of one exposure field blank sample must be prepared and analyzed per day of sampling.

Test Quantity

- See Table 2 in *General Guidelines*.

Reporting & Compliance

- Compliance is based on the measured concentration at each location compared against the requirement in WELL + tolerance of 20%.

Device Requirements

- Laboratory materials and/or samplers must be prepared according to the referenced testing methodology and meet the referenced testing methodology requirements.
- Single tube sampling at each test location is acceptable as an alternative to distributed volume pair sampling. Note that any impact to data quality (e.g., insufficient sample volume, breakthrough) is the responsibility of the testing agent.
- Air sampling pumps utilized in active collection measurements must be capable of meeting the airflow rates prescribed by the referenced testing methodology (if applicable).

VOCs (other than Formaldehyde and Acetaldehyde)

Features

Total VOCs

- WELL v1: Feature 01, Part 1

Component VOCs:

- v1: Feature 01, Part 1 AAP
- WELL v2 and WELL v2 pilot: Features A01, Part 2; A05, Part 2
- WELL Performance Rating: PA3, PA4, PM1

Test Locations & Conditions

- See *General Guidelines*.

Test Method

- Samples are taken through an active collection in accordance with ISO 16000-6, ASTM D5197, EPA TO-15 or EPA TO-17.
- The following methods are acceptable alternatives for speciating individual VOCs:
    - Acrylonitrile: NIOSH 1604 (modified methodology acceptable to reach ppb concentrations.
    - Caprolactam: OSHA PV2012 (modified methodology acceptable to reach ppb concentrations).
- A minimum of one exposure field blank sample per day of sampling must be prepared and analyzed.

Test Quantity

- See Table 2 for the number of sampling locations.
- Minimum of one continuous hour OR the duration of sampling volume prescribed by the referenced testing methodology.

Reporting & Compliance

- For tests for WELL v2 Features A01 or A05, compliance is based on the measured concentration at each location compared against each VOC's requirement in WELL + tolerance of 5%.
- For tests of WELL v1 Feature 01, compliance is based on each location either meeting the conditions above or the measured TVOC concentration compared against the requirement in WELL.

Device Requirements

- Laboratory materials and/or samplers must be prepared according to the referenced testing methodology and meet the referenced testing methodology requirements.
- Single tube sampling at each test location is acceptable as an alternative to distributed volume pair sampling. Note that any impact to data quality (e.g., insufficient sample volume, breakthrough) is the responsibility of the testing agent.

- Air sampling pumps utilized in active collection measurements must be capable of meeting the airflow rates prescribed by the referenced testing methodology (if applicable).

Carbon monoxide

Features

- WELL v1: Feature 1, Part 2
- WELL v2 and WELL v2 pilot: Features A01, Part 3; A05, Part 3
- WELL Performance Rating: PA5, PA6, PM1

Test Locations & Conditions

- See *General Guidelines*.

Test Method

- Minimum of one continuous hour (10 minutes of acclimation time followed by 50 minutes of measurement time), with measurements recorded at least once every minute.

Test Quantity

- See Table 2 in *General Guidelines*.

Reporting & Compliance

- Compliance is based on the median value collected during the measurement time at each sampling compared with the WELL requirements.

Device Requirements

- Direct reading instrument.
- Measurement range: 0-25 ppm
- Instrument resolution: 0.1 ppm
- Lower detectable limit: 0.1 ppm
- Calibration: instrument must be within the calibration period

Ozone

Features

- WELL v1: Feature 01, Part 2
- WELL v2 pilot: Features A01, Part 3; A05, Part 3
- WELL v2: Feature A01, Part 3
- WELL Performance Rating: PA5, PM1

Test Locations & Conditions

- See *General Guidelines*.

Test Method

- Minimum of one continuous hour (10 minutes of acclimation time followed by 50 minutes of measurement time), with measurements recorded at least once every minute.

Test Quantity

- See Table 2 in *General Guidelines*.

Reporting & Compliance

- Compliance is based on the median value collected during the measurement time at each sampling point compared against the requirement in WELL + a tolerance of 5%.

Device Requirements

- Direct reading instrument.
- Measurement range: 0-500 ppb
- On-screen resolution: 1 ppb
- Lower detectable limit: 3 ppb
- Calibration: instrument must be within the calibration period

Nitrogen dioxide

Features

- WELL v2 and WELL v2 pilot: Feature A05, Part 3
- WELL Performance Rating: PA6, PM1

Test Locations & Conditions

- See *General Guidelines*.

Test Method

- Duration: up to one hour

Test Quantity

- See Table 2 in *General Guidelines*.

Reporting & Compliance

- Compliance is based on the median value collected during the measurement time at each sampling point compared against the requirement in WELL + a tolerance of 20%.

Device Requirements

- Measurement range: 0-500 ppb
- Lower detectable limit: 5 ppb
- Calibration: instrument must be within the calibration period

Radon

Features

- WELL v1: Features 01, Part 3

Test Locations & Conditions

- Measurements are only required in the lowest occupied level of the project site. If the project does not contain the ground floor of the building (defined as the first aboveground floor) or any below-grade floors, radon testing is not required.
- Radon samplers must be located a minimum distance of:
    - 0.91 m [3 ft] from windows and exterior doors

    - 20.3 cm [12 in] from exterior walls
    - 50.8 cm [20 in] above the finished floor

Test Method

- Active or short- or long-term passive testing samples are permitted.
- Minimum of 48 hours for passive testing samples. The entire length of the performance verification is required for active testing samples.

Test Quantity

- One radon sampler is required in each 2300 m^2 [25,000 ft^2] of the project area on the lowest occupied level.

Reporting & Compliance

- Compliance is based on every test location complying with the requirement in WELL.

Device Requirements

- Passive or active radon sampler.

Water

General Guidelines

Unless otherwise noted, these rules apply to all parameters within the Water concept.

Test Locations & Conditions

- These tests use a sample of water from the cold-water fixture, when possible. If conditions exist preventing adjustment of the water temperature, perform the testing at the temperature of the water provided and make note of conditions.
- For WELL v1 Core & Shell, WELL v2 Core and WELL v2 pilot Core projects, samples must come from points that deliver water of the same quality as what is available to tenant spaces. Samples may be taken after point-of-use treatment devices only if the project has documented policies giving allowances to tenants to acquire and install such units.

Test Method

- Run the water for at least 30 seconds before gathering a water sample (unless the sample is drawn immediately following a previous sample).

Test Quantity

- For each configuration of in-building water treatment, determine the total number of fixtures (as applicable) for drinking water, handwashing, showers/baths and for cooking purposes.
- Of these, test at 5% (round up), with a maximum of four per configuration.
- Include the most distal (furthest from the main supply) outlet in the tests.
- For dwelling units, unless otherwise stated, sample points should be taken as follows:
    - Projects with 20 units or fewer: one unit of each configuration
    - Projects with 21-100 units: two units of each configuration
    - Projects with more than 100 units: three units of each configuration

Turbidity

Features

- WELL v1: Feature 30, Part 1
- WELL v2 and WELL v2 pilot: Feature W01, Part 1

Test Locations & Conditions

- See *General Guidelines*.
- This parameter is tested at drinking water fixtures, handwashing fixtures, fixtures for showers and baths, and water fixtures used for cooking purposes for commercial kitchens (as applicable).

Test Method

- See *General Guidelines*.
- Mix the sample to thoroughly disperse the solids. Wait until air bubbles disappear, then pour the sample into the turbidimeter tube.
- Repeat turbidity test twice, for a total of three samples at a water fixture.

Test Quantity

- See *General Guidelines*.

Reporting & Compliance

- At each fixture, average the turbidity of the three samples.
- Compliance is based on the average at each fixture meeting the requirements listed in WELL.

Device Requirements

- Turbidimeter meets or exceeds requirements of EPA Method 180.1.
- Measurement range: 0-40 NTU or greater
- Reporting resolution: 0.02 NTU or finer
- Accuracy: ±2% of reading
- Lowest detectable limit: 0.05 NTU or lower
- Maintain device calibration in accordance with the manufacturer's instructions.

Coliforms

Features

- WELL v1: Feature 30, Part 2
- WELL v2: Feature W01, Part 1
- WELL v2 pilot: Feature W01, Part 2

Test Locations & Conditions

- See *General Guidelines*.
- This parameter is tested at drinking water fixtures, handwashing fixtures, fixtures for showers and baths, and water fixtures used for cooking purposes for commercial kitchens (as applicable).

Test Method

- See *General Guidelines*
- Do not "flame" (sanitize) or remove aerator from faucet.
- Package and ship sample to testing laboratory per the laboratory's instructions. Total coliforms sampling analysis is time sensitive and the samples should be shipped overnight to the laboratory the same day they are collected, or couriered or driven to the laboratory the day they are collected.

Test Quantity

- See *General Guidelines*.

Reporting & Compliance

- Each sample analyzed must comply with the requirement in WELL.

Laboratory Requirements

- Water samples are evaluated by a third-party laboratory in accordance with 40 CFR 141.74(a)(1) or ISO 9308-1:2001 or a more recent version.

Disinfectants

Features

- WELL v1: Feature 34, Part 1
- WELL v2: Feature W02, Part 1
- WELL v2 pilot: Feature W02, Part 6 b and c

Test Locations & Conditions

- See *General Guidelines*.
- This parameter is tested at drinking water fixtures and water fixtures used for cooking purposes for commercial kitchens (as applicable).

Test Method

- See *General Guidelines*.
- Take measurements of total and free chlorine of samples by adding the appropriate reagents as specified by the chlorine meter manufacturer. To calculate residual chloramines, subtract the free chlorine value from the total chlorine value.
- Repeat the process twice, for a total of three samples per water fixture tested.

Test Quantity

- See *General Guidelines*.

Reporting & Compliance

- At each fixture, the average of the three samples must comply with the requirements in WELL.

Device Requirements

- Measurement range: 0-5 mg/L
- Reporting resolution: 0.01 mg/L or finer
- Accuracy: ±0.02 mg/L at 1.00 mg/L

Lead

Features

- WELL v2 and WELL v2 pilot: Feature W02, Part 1

Test Locations & Conditions

- See *General Guidelines*.
- This parameter is tested at drinking water fixtures and water fixtures used for cooking purposes (as applicable) for commercial kitchens.

Test Methods

- Run the water for at least 30 seconds before gathering a water sample (unless the sample is drawn immediately following a previous sample).
- Appropriate sampling vials must be obtained from the laboratory prior to performance testing.
- Follow all laboratory procedures for collecting and packaging the sample.

Test Quantity

- Samples are selected with the following priority:
- a distal (furthest floor from the main supply, or as far as possible in single-floor projects) outlet.
- a proximal (close to the main supply) outlet.
- For each configuration of in-building water treatment, determine the total number of fixtures (as applicable) for drinking water, handwashing, showers/baths and for cooking purposes.
- Of these, test at 5% (round up), with a maximum of four per configuration.

Reporting & Compliance

- The sample from every fixture tested must meet the requirements in WELL for lead.

Laboratory-based Contaminants (except Lead)

Features

- WELL v1: Features 31, Part 1; 32, Part 1; 33, Parts 1 and 2; 34, Part 3; 37, Part 1
- WELL v2: Features W02, Part 1; W04, Part 1
- WELL v2 pilot: Features W02, Parts 1, 2, 3, 4, 5 and 6a; W04, Part 1

Test Locations & Conditions

- See *General Guidelines*.
- This parameter is tested at drinking water fixtures and water fixtures used for cooking purposes (as applicable) for commercial kitchens.

Test Method

- See *General Guidelines*.
- Appropriate sampling vials must be obtained from the laboratory prior to performance testing.
- Follow all laboratory procedures for collecting and packaging the sample.

- Package and ship sample to third party testing laboratory per the laboratory's instructions.
- This parameter is tested at drinking water fixtures and water fixtures used for cooking purposes for commercial kitchens (as applicable).

Test Quantity

- For each configuration of in-building water treatment, determine the total number of fixtures (as applicable) for drinking water, handwashing, showers/baths and for cooking purposes.
- Of these, test at 5% (round up), with a maximum of two per configuration.
- Include the most distal (furthest from the main supply) outlet in the tests.

Reporting & Compliance

- The sample from every fixture tested must meet the requirements in WELL for each of the contaminants being tested.
- For Styrene samples, a "Not Detected" measurement with a limit of detection of .001 mg/L is considered acceptable.

Light

Visual Lighting

Features

- WELL v1: Feature 53, Part 1
- WELL v2 and WELL v2 pilot: Feature L02, Part 1

Test Locations & Conditions

- This parameter is measured on the horizontal plane.
- For WELL v1 Feature 53, the surface of a desk may be considered as the working plane for both sitting and standing desk surfaces. For WELL v2 and WELL v2 pilot Feature L02, working plane heights and target illumination levels are to be provided by project teams.
- This parameter is to be measured using only electric lighting. Take measurements at night to avoid daylight contribution.
- If supplemental lighting is used, the lighting should be turned on and positioned as per regular conditions.
- The WELL Performance Testing Agent may follow instructions by the project team to turn screens on or off. However, agents are not to alter field conditions in any other way including influencing or controlling lighting automation (changing brightness levels, color or color temperature) and/or directing the adjustments made by the project team.

Test Method

- The measuring instrument is placed in the center of the flat surface of the working plane with the aperture facing upward.
- Ensure that the shadow of the WELL Performance Testing Agent does not fall on the measuring instrument while the measurements are taken.

Test Quantity

- The measurements must be conducted at various locations across the project boundary, including both interior and exterior spaces.
- Measurements are conducted across one floor in projects that consist of one to four floors. If the project has five or more floors, measurements are to be conducted across two floors.
- The floor that is identified for measurements must be regularly used by a representative sample of the occupants. For example, if a project has four floors out of which one consists of the lobby and the other three consist of offices, the measurements must be conducted on one floor that contains offices.
- To identify sampling points, apply a grid with 3 m x 3 m [10 ft x 10 ft] squares across the entire floor that has been identified for measurement.
- Take one measurement per square, up to a maximum of 50 measurements per floor, provided at least three measurements per task are taken within the project (see below).
- Within each square, measurements are to be taken at a point that is representative of the occupant's position. For example, for a workstation, the sampling point would lie at the center of the desk in front of the occupant; for a corridor, the sampling points would be at the center of the corridor.
- Ensure that at least three measurements are taken for each task and/or application submitted by the project team. Tasks/applications may include, but are not limited to:
    - Circulation corridor
    - Reception desk
    - Aerobic exercise area
    - Food preparation
    - Reading and writing in a classroom
- This may require multiple measurements in a single grid square or more than 50 measurements per floor.
- All sampling points must be representative of typical occupied areas within the sampling zone.
- For dwelling units, unless otherwise stated, sampling should be distributed between different unit types. At least one of each type of room described in the feature in each unit is evaluated:
    - Projects with 15 units or fewer: four units
    - Projects with 16-50 units: 25% of the units
    - Projects with more than 50 units: 15 units

Reporting & Compliance

- The average light levels across identical tasks must meet the target illuminance throughout the project boundary.
- The lowest light level measured across workspaces must be at least half of the target illuminance.

Device Requirements

- All illuminance measurements are to be conducted with a cosine corrected illuminance meter.
- Range: 5-50,000 lux
- Maximum acceptable overall error: ±5% (at values up to 2000 lux)
- Resolution: 1 lux (at values up to 2000 lux)
- The illuminance meter is calibrated as per manufacturer specifications in an ISO/IEC 17025:2017 Accredited Calibration Lab, or calibration must be traceable to a National Metrological Institute, such as NIST, NPL, or PTB.

Circadian Lighting

Features

- WELL v1: Feature 54, Part 1
- WELL v2 and WELL v2 pilot: Feature L03, Part 1

Test Locations & Conditions

- This parameter is to be measured on the vertical plane to simulate the light entering the eye of the occupant.
- Sampling points must be representative of the common occupant position in the space under regular conditions.
- For space types with workstations, this parameter must be measured 45 cm [18 in] above the working plane (the surface of a desk may be considered as the working plane for both sitting and standing desk surfaces).
- For dwelling units, the sampling points must be located in non-sleeping areas such as the living, kitchen, and study (e.g., home office). If a sample furniture layout is not provided, the sample points may be considered in the center of each room.
- If no working planes are present in the space type (for instance, a living room or a commercial interior before tenant buildout), four measurements are to be conducted at the height indicated in the feature language in orthogonal directions. The median value of the four measurements is to be used as the measurement value for each sampling point.
- If supplemental lighting is used, the lighting should be turned on and positioned as per regular conditions.
- The WELL Performance Testing Agent may follow instructions by the project team to turn computer screens (if present) on or off. However, they are not to alter field conditions in any other way, including influencing or controlling lighting automation (changing brightness levels, color or color temperature), modifying furniture and/or directing the adjustments made by the project team.
- The measurements of WELL v1 Feature 54, Part 1.b and WELL v2 and WELL v2 pilot Feature L03 are taken under electric lighting only. Take measurements at night to avoid daylight contribution.
- The measurements of WELL v1 Feature 54, Part 1.a include the contributions of daylight and are measured between 9:00 am and 1:00 pm. Thus, for WELL v1 projects, take measurements under both daylight and nighttime conditions.

Test Method

- Measurements must be recorded on a vertical plane (perpendicular to the floor) to simulate the light entering the eye of the occupant.
- The measuring instrument must be mounted on a tripod and placed on a stable surface for each measurement.
- Ensure that the shadow of the WELL Performance Testing Agent does not fall on the measuring instrument as the measurements are taken.

Test Quantity

- For applicable areas that are not dwelling units, the total number of tests for this parameter is $n = \frac{68N}{N+67}$, where *N* is the total number of workstations and desks within classrooms. For a commercial interior before tenant buildout, use default occupancy assumptions to determine *N*.
- The measurements must be distributed across different floors (if applicable).
- For dwelling units, take one sample in the applicable rooms with a maximum of 3 rooms per dwelling unit.

Reporting & Compliance

- Report the lux levels and the spectral power at 5 nm increments from 380 nm to 730 nm. The methodology described in Table L2 in WELL (EML = lux × melanopic ratio) will be used to calculate the equivalent melanopic lux using the recorded spectral power values.
- For WELL v1 Feature 54, Part 1.b in v1 and WELL v2 and WELL v2 pilot Feature L03, the median light levels must meet the EML threshold and the lowest value must be at least half the threshold.
- For WELL v1 Feature 54, Part 1.a, the 25th percentile of the measurements must meet the EML threshold.
- A tolerance of -5% EML may be considered for the measurements taken.

Device Requirements

- All measurements are to be conducted with a cosine corrected optical spectrometer.
- The instrument must function within the limits of the performance specifications in the below requirements when operated in accordance with the operation manual:
    - Wavelength range: 380-780 nm
    - Maximum acceptable overall error: ±5%
    - Optical Resolution: 10 nm or less
    - Range: 5-50,000 lux
    - Resolution: 1 lux (at values up to 2000 lux)
- The meter is calibrated as per manufacturer specifications in an ISO/IEC 17025:2017 Accredited Calibration Lab, or calibration must be traceable to a National Metrological Institute, such as NIST, NPL or PTB.

Alternate Device Requirements & Protocol

- A spectrometer that is *not* cosine corrected but which meets the other device requirements may be used for testing this parameter in conjunction with a

photometer that meets the device requirements for Visual Lighting parameter. In this case, measurements from both the photometer and spectrometer are taken in the same position, as described in Test Method. In the formula EML = lux × melanopic ratio, the melanopic ratio is calculated using the data from the spectrometer and the lux value is taken from the cosine-corrected photometer.

Thermal Comfort

General Guidelines

Unless otherwise noted, these rules apply to all parameters within the Thermal Comfort concept.

Test Locations & Conditions

- Sampling points must be representative of typical occupied areas within the sampling zone.
- Sampling points must be located at least 1 m [3.3 ft] away from windows, walls, doors, direct sunlight, mechanical system supply outlets, fans, heaters or any other significant source of heat or cold. To the extent possible, sampling points should be at least 5 m [16.4 ft] from exterior doors.
- For projects with multiple floors, the measurements must be distributed across different floors, including the lowest and the highest regularly occupied floor.
- The measurements must be conducted at various locations across the building floor area, including both interior space and in proximity to façades with different orientations.

Test Method

- Total of 10 minutes, with measurements recorded at least once every minute.
- The WELL Performance Testing Agent should note whether the HVAC system (or any ventilation and air treatment method) is on or off during the data collection period.

Test Quantity

- Measurements are recorded in 8% of the total number of each regularly occupied room type in the project (at least one of each room type).
- For Multifamily Residential projects, unless otherwise stated, sample points should be taken as follows:
    - Projects with 10 dwelling units or fewer: two of each unit type
    - Projects with more than 10 dwelling units: 5% of each unit type, with a minimum of three and a maximum of 10 units of each unit type
- To determine the test quantity for all other non-dwelling spaces, follow Table 2 sampling point guidance for the total area of regularly occupied spaces only, not the total project area (e.g., occupied lobbies and gyms are considered regularly occupied spaces and therefore would be included in the Table 2 calculations; common areas such as hallways are not considered regularly occupied spaces and therefore would not be included in the calculations).

Dry-bulb Temperature

Features

- WELL v1: Feature 76, Parts 1, 2 and 3
- WELL v2 pilot: Features T01, Part 1; T02, Part 1
- WELL v2: Feature T01, Part 1

Test Locations & Conditions

- See *General Guidelines*.
- Each sampling point is tested at three heights: 0.1 m, 0.6 m and 1.1 m (4 in, 24 in and 43 in, respectively) for seated occupants or 0.1 m, 1.1 m and 1.7 m (4 in, 43 in and 67 in, respectively) for standing occupants.

Test Method

- See *General Guidelines*.

Test Quantity

- See *General Guidelines*.

Reporting & Compliance

- The median value of the average of the measurements at the three test heights collected during the measurement time at each sampling point is reported and used to determine compliance with the WELL requirements.

Device Requirements

- Method of measurements: direct reading instrument
- Measurement range: 10 °C to 40 °C [50 °F to 100 °F]
- On-screen resolution: 0.5 °C [0.9 °F]
- Instrument accuracy: ±0.5 °C [±0.9 °F]
- Calibration: instrument must be within the calibration period

Mean Radiant Temperature

Features

- WELL v1: Feature 76, Parts 1, 2 and 3
- WELL v2 pilot: Features T01, Part 1; T02, Part 1
- WELL v2: Feature T01, Part 1

Test Locations & Conditions

- See *General Guidelines*.
- Each sampling point is tested at 0.6 m [24 in] for seated occupants or 1.1 m [43 in] for standing occupants.

Test Method

- Mean radiant temperature can be determined one of two ways, both described in ASHRAE Handbook of Fundamentals, Chapter 9.10.:
    - It can be determined with a spherical or ellipsoidal shape globe thermometer method.

    - It can be calculated from the measured temperature of surrounding walls and surfaces and their positions with respect to the person (with the emissivity assumption that all surfaces in the room are considered to be black). This method can be practically accomplished by pointing a radiometer with a 90-degree acceptance cone toward each of the six surrounding surfaces and averaging the readings to produce one mean radiant temperature value.
- Total of 10 minutes, with measurements recorded at least once every minute.

Test Quantity

- See *General Guidelines*.

Reporting & Compliance

- The median value collected during the measurement time at each sampling point is reported and used to determine compliance with the WELL requirements.

Device Requirements

- Method of measurements: direct reading instrument
- Measurement range: 10 °C to 40 °C [50 °F to 100 °F]
- Instrument resolution: 0.5 °C [0.9 °F]
- On-screen resolution: 0.5 °C [0.9 °F]
- Instrument accuracy: ±1 °C [1.8 °F]
- Calibration: instrument must be within the calibration period

Relative Humidity

Features:

- WELL v1: Feature 76, Parts 1 and 2
- WELL v2 pilot: Features T01, Part 1; T02, Part 1; T07, Part 1
- WELL v2: Features T01, Part 1; T07, Part 1

Test Locations & Conditions

- See *General Guidelines*.
- Sampling points must be 1.1-1.7 m [3.6-5.6 ft] above the finished floor.

Test Method

- See *General Guidelines*.

Test Quantity

- See *General Guidelines*.

Reporting & Compliance

- Compliance is based on the median value collected during the measurement time at each location compared against the requirement in WELL + tolerance of 3.0% rH.

Device Requirements

- Direct reading instrument.
- Measurement range: 5-95%
- Instrument resolution: 0.3%

- On-screen resolution: 1%
- Instrument accuracy: ±3.0% from 10-90% relative humidity
- Calibration: instrument must be within the calibration period

Sound

General Guidelines

Unless otherwise noted, these rules apply to all parameters within the Sound concept.

Test Locations & Conditions

- The measurements must be taken at a minimum of 1.2 m [4 ft] above the finished floor.
- The measurements must not be taken within 1.5 m [5 ft] of noise sources, fenestration or other exterior penetration (e.g., piping or other externally ducted HVAC equipment).
- It is highly recommended that the WELL Performance Testing Agent utilizes hearing protection when operating loudspeakers.
- It is recommended that, when possible, the spatial average be measured by rotating the sound level meter at arm's length at a speed of 15 cm [6 in] per second during sound pressure measurements. Note that this does not apply to Reverberation Time (RT60) tests.

Test Method

- Avoid transient interior sounds (e.g., people talking, doors closing) during the measurement periods. If there are internal noises (other than the HVAC system or building services such as escalators or elevators) lasting longer than 10 seconds, the measurement should be deleted and restarted.
- To the extent possible, testing should occur when the space is unoccupied or when the fewest number of people are on-site or nearby.
- WELL Performance Testing Agent should note sources of noise that may impact the results of sampling for the benefit of potential remediation upon non-compliance with WELL thresholds. Examples include, but are not limited to, exterior noise intrusion from industrial, pedestrian, traffic, mechanical or weather-related sources and interior noise from mechanical, occupant, construction or other building services.
- For dwelling units, unless otherwise stated, sampling should be distributed between different unit types. At least one of each type of room described in the feature in each unit is evaluated:
    - Projects with 15 units or fewer: four units
    - Projects with 16-50 units: 25% of the units
    - Projects with more than 50 units: 15 units

Device Requirements

- Type 1/Class A sound level meter with whole and ⅓-octave measuring capabilities.
- Sound level meter is annually calibrated in accordance with ANSI/ASA S1.4-2014, IEC 61672-1:2013 or regionally equivalent standard.
- Sound level meter must be capable of reporting parametric results as Leq, LMax, L90, L10 and both slow and fast weightings.

- Measurement Equipment Parameters:
    - Bandwidth: At least 31.5 Hz to 8 kHz
    - Accuracy: ±0.5 dB at 1 kHz
    - On-screen resolution: 0.1 dB

Exterior Noise Intrusion (dBA)

Features

- WELL v1: Feature 74, Part 1

Test Locations & Conditions

- See *General Guidelines*.
- The HVAC system must be off during the measurement periods.
- Sound masking systems (if present) must be off for the duration of the measurement period.
- The sample points must be located as close to 1 m [3.3 ft] away from the window wall as possible while still located where an occupant would typically be situated.
- As much as possible, the sample points should be located farthest from sources of mechanical noise, including HVAC system ducts and elevators, while still located where an occupant would typically be situated.
- The distance between any two points of measurement must be at least 3 m [10 ft].
- If the windows are normally closed, the sound level measurements must occur with the windows closed. If the windows are normally open (e.g., naturally ventilated spaces), the sound level measurements must occur with the windows open.

Test Method

- See *General Guidelines*.
- Each measurement should last at minimum 30 seconds at each test location.

Test Quantity

- At least one measurement in each room type listed for at least 10% of the total number of floors in the project. The preference for the first sampling point is given to the floor that is at or nearest to the ground level. The preference for the second sampling point (if applicable) is the floor at a similar height to adjacent rooftop mechanical equipment or other elevated exterior sources of noise. The preference for third sampling point (if applicable) is the floor beneath rooftop mechanical equipment.

Reporting & Compliance

- The time-averaged, slow-weighted and A-weighted sound pressure level (Leq) recorded during the measurement period will be used to determine compliance with the WELL threshold.

Device Requirements

- See *General Guidelines*.

Internally Generated Noise (NC or NR)

Features

- WELL v1: Feature 75, Part 2

Test Locations & Conditions

- See *General Guidelines*.
- The HVAC system must be on during the measurement periods.
- Sound masking systems (if present) must be off during the measurement period.
- The measurements must be located where an occupant would typically be situated within the space.
- As much as possible, measurements should be located in regularly occupied spaces near sources of mechanical noise, including HVAC system ducts and elevators.
- As much as possible, measurements should be located away from walls containing windows.
- The distance between any two points of measurement must be at least 3 m [10 ft].
- Windows and doors in the measurement location must be closed.

Test Method

- See *General Guidelines*.
- Each measurement should last at minimum 30 seconds in each test location.

Test Quantity

- At least one measurement in each room type specified in WELL v1 Feature 75 for 10% of the total number of applicable floors.
- Preference in selecting which floors are measured must be given firstly to floors where base building mechanical equipment rooms are present, and secondly to floors that locate directly beneath rooftop mechanical equipment.
- In open workspaces, one measurement should be taken for every 46 m^2 [500 ft^2].

Reporting & Compliance

- The time-averaged, slow-weighted and A-weighted sound pressure level (L90) measured at each of the following octave band frequencies is plotted against noise criteria curves and rounded down to the nearest increment of 1 NC/NR for maximum noise level to determine the noise criterion: 31.5 Hz (for Noise Rating), 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, and 8 kHz (for Noise Criterion).

Device Requirements

- See *General Guidelines*.

Disruptive Noise Limitation

Features

- WELL v1: Feature 75 Part 7

Test Locations & Conditions

- See *General Guidelines*.

- The measurements must be performed when the space is unoccupied (e.g., prior to opening or after hours).
- Music must be off for one ambient measurement, and music must be on for at least one measurement.
- As much as possible, avoid transient sounds (e.g., people talking, traffic noise, etc.) during measurement.
- As much as possible, measurements should be taken away from walls and other building structures. The sampling points must be located a minimum of 1.2 m [48 in] above the ground.
- If the conditions specified above are violated during the measurement, the measurement must be halted, data must be discarded, and the measurement must be restarted.

Test Method

- See *General Guidelines*.
- Each measurement should last a minimum of 30 seconds in each test location.

Test Quantity

- At least two measurements (maximum of four) and measured at a distance of 4.5 m [15 ft] outside of the entrance to the space.

Reporting & Compliance

- The time-averaged, A-weighted sound pressure level recorded during the measurement period will be used to determine compliance with the WELL threshold.
- Note any existing intruding sounds that may interfere with an accurate measurement of noise criterion (e.g., traffic noise).

Device Requirements

- See *General Guidelines*.

Background Noise Levels

Features

- WELL v2 and WELL v2 pilot: Feature S02

Test Locations & Conditions

- See *General Guidelines*.
- The HVAC system and other sound emitting building services (e.g., escalators, elevators, appliances) must be on during the measurement periods.
- Sound masking systems (if present) must be off for the duration of the measurement period.
- The sample points must be located at the location where an occupant would typically be situated within the space.
- As much as possible, the sample points must be located 1 m [3.3 ft] from any windows or walls, while still located where an occupant would typically be situated.
- The distance between any two points of measurement must be at least 3 m [10 ft].

- If the windows are normally closed, the sound level measurements must occur with the windows closed. If the windows are normally open, the sound level measurements must occur with the windows open.
- For WELL v2 pilot, with regards to the thresholds for Residential Sleeping Areas, "Daytime" measurements are taken after 7:00 a.m. and before 10:00 p.m. and "Nighttime" measurements are after 10:00 p.m. and before midnight.

Test Method

- See *General Guidelines*.
- Each measurement should last at minimum five minutes at each test location, except for open workspaces. Measurements in open workspaces should last at minimum 30 seconds at each test location.
- For WELL v2 projects, dwelling unit measurements must be taken over the course of a 12-hour minimum period which includes, at minimum, the hours of 10:00 pm to 7:00 am.

Test Quantity

- In open workspaces and areas with regularly used PA systems, one measurement should be taken for every 46 m^2 [500 ft^2] up to a maximum of 10 measurements per floor.
- In dwelling units, one measurement should be taken in a bedroom with façade and interior mechanical equipment that is representative of typical bedroom construction. Preference is given to dwelling units that locate near sources of exterior noise (e.g., road traffic, railways, harbors, rooftop mechanical equipment, garage doors, outdoor recreation areas) and local floor mechanical equipment rooms.
- For all other spaces, at least one measurement is taken in each room type listed, for 10% of the total number of floors in the project. The preference for the first sampling point is given to the floor that is at or nearest to the ground level. The preference for the second sampling point, if applicable, is the floor at a similar height to adjacent rooftop mechanical equipment or other elevated exterior sources of noise. The preference for third sampling point (if applicable) is the floor beneath rooftop mechanical equipment.

Reporting & Compliance

- Compliance of the Leq values is based on the A-weighted and C-weighted measurement achieving the optimal level within a +4 dB tolerance. Compliance of the Lmax values is based on the A-weighted and C-weighted measurement achieving the optimal level within a +9 dB tolerance. All measurements are taken using slow weighting.
- All measurements taken in open workspaces should be averaged to a single time-averaged slow-weighted sound pressure level for each criterion (dBA and dBC for both Leq and LMax).

Device Requirements

- See *General Guidelines*.

Sound Masking

Features

- WELL v1: Feature 79, Part 2
- WELL v2 pilot: Feature S05, Part 1

Test Locations & Conditions

- See *General Guidelines*.
- The HVAC system must be on during the measurement periods.
- Sound masking system must be on during the measurement periods.
- The measurements must be taken where an occupant would typically be situated.

Test Method

- See *General Guidelines*.
- Each measurement should last atd minimum 30 seconds in each test location.

Test Quantity

- At least 10% of the total number of regularly occupied spaces where sound masking is present.

Reporting & Compliance

- The slow-weighted, A-weighted L90 sound pressure level recorded during the measurement period will be used to determine compliance with the WELL threshold.

Device Requirements

- See *General Guidelines*.

Sound Insulation

Features

- WELL v2 pilot: Feature S03, Part 1
- WELL v2: Feature S03, Part 2

Test Locations & Conditions

- See *General Guidelines*.
- The HVAC system must be on during the measurement periods.
- Sound masking systems (if present) must be on during the measurement period.
- The measurements must be located where an occupant would typically be situated within the space.
- As much as possible, measurements should be located away from walls containing windows.
- The distance between any two points of measurement must be at least 3 m [10 ft].
- Windows and doors in the measurement location must be closed.

Test Method

- See *General Guidelines*.
- Loudspeaker should be placed near the wall at the opposite side of the room from the wall that is being tested. If a non-omnidirectional speaker is used, to the extent

possible, it should be aimed into a trihedral corner along this wall (i.e., where two walls join at right angles).
- The minimum level of the operating loudspeaker should be at least 90 dBA.
- Each measurement should last at minimum 30 seconds in each receiving room measurement location. If the receiving room has already been assessed for compliance with WELL v2 or WELL v2 pilot Feature S02 Part 1, data from the measurement (L90) may be used for Reporting & Compliance in lieu of taking an additional NIC/Dw measurement in that receiving room.

Test Quantity

- At least 10% of each regularly occupied space type listed, one measurement per measurement location.
- For WELL v2 pilot projects, preference should be given to rooms that separate two acoustically sensitive spaces such as conference rooms, wellness rooms or where the requirement is SPP-80 or greater.
- Preference should be given to walls with any element of glazing and/or doors.

Reporting & Compliance

- Sound isolation and speech privacy metrics must be reported by following one of the following methods, as applicable:
- Noise Isolation Class (NIC) is calculated from L10 of the source measurement, L90 of the receiving location with source on, and L90 of the ambient background level (source off) of the receiving room (see below). L10 and L90 measurements for NIC calculations are evaluated across 125 Hz and 4 kHz.
- Sound Insulation (Dw) is calculated from Leq of the source measurement and receiving room with source on and off, assuming a room reverberation time of 0.5 seconds (unless known through evaluation of S04.1, as applicable). Both Dw and dBA L90 measurements are evaluated across 100 Hz and 3150 Hz.
- Speech Privacy Potential (SPP) is the sum of either Noise Criteria (NC) + Noise Isolation Class (NIC) OR background noise (dBA L90) + sound insulation (Dw).
- Noise Criteria (NC) is the single number criteria based on L90 background noise measurement from 63 Hz to 8 kHz taken in the receiving room space (see Reporting & Compliance for Internally Generated Noise for additional guidance).

Device Requirements

- Sound Level Meter:
    - See *General Guidelines*.
- Loudspeaker:
    - Minimum 0.25 m [10 in] diameter
    - Minimum frequency response of at least 100 Hz – 4 kHz
    - Maximum output of at least 100 dB
    - Noise generator capable of producing white/pink noise of equal sound energy across all frequencies of interest

Reverberation Time (RT_{60})

Features

- WELL v1: Feature 78, Parts 1 and 2
- WELL v2 and WELL v2 pilot: Feature S04, Part 1

Test Locations & Conditions

- See *General Guidelines*.
- The HVAC system must be on during the measurement periods.
- Sound masking systems (if present) must be on during the measurements.
- The sampling points should be located at least 1 m [3.3 ft] from any sound-reflecting surfaces.
- The impulse sound source must be at least 1 m [3.3 ft] from both the sound measuring device and sound-reflecting surfaces.

Test Method

- See *General Guidelines*.
- For the noise source impulse:
- If generated via balloon burst, inflate balloon to 0.4 m [16 in] diameter. Then, arm or ready the sound level meter by measuring the baseline background noise level. Once the meter is armed for impulse, burst balloon using a pen or similar. Allow approximately 10 seconds for the meter to capture impulse response at all frequencies.
- If generated via loudspeaker, arm and ready the meter by measuring the baseline background noise level. Then, excite the room by turning the loudspeaker on to approximately 90 dBA using a white/pink noise generator. Once the sound level meter is armed for impulse measurement, turn off the sound source and wait approximately 10 seconds for the sound level meter to capture the impulse response at all frequencies.

Test Quantity

- Three measurements of approximately 10 seconds (or however long is needed to capture impulse response across all frequencies) per measurement location.
- At least 10% of the total number of applicable spaces, with preference given to rooms that require higher degrees of speech intelligibility with the following order of descending priority: lecture rooms, classrooms and conference rooms.

Reporting & Compliance

- The average RT_{60} value from 500 Hz - 1 kHz of the three measurements per measurement location is used to determine compliance with the WELL threshold.

Device Requirements

- Sound Level Meter:
    - See General Guidelines
- Balloon of minimum diameter 0.4 m [16 in]

OR

- Loudspeaker:
    - Minimum 0.25 m [10 in] diameter
    - Minimum frequency response of at least 100 Hz – 4 kHz
    - Maximum output of at least 100 dB
    - Noise generator capable of producing white/pink noise of equal sound energy across the frequencies of interest

Continuous Monitoring Protocols for WELL

General Guidelines

Several WELL features within the WELL Building Standard version 2 (WELL v2) and WELL Ratings can be pursued through the implementation of permanently installed continuous monitors that measure environmental parameters through sensor technology. This section describes the continuous monitoring protocol for each feature and part that incorporates continuous monitoring as part of the verification method. Unless otherwise noted, these rules apply to all parameters in Table 3.

Note: continuous monitoring and sensor technology are rapidly developing; therefore this section may be frequently updated to stay current with industry best practices

Table 3: Parameters and Features/Parts that Incorporate Continuous Monitoring Pathways

Parameter		WELL v2 Feature/Part	WELL Performance Rating Feature
Particulate Matter 2.5	$PM_{2.5}$	A01 Part 1; A01 Part 5; A05 Part 1; A07 Part 2; A08 Part 1	PA1, PA2, PM1, PM2
Particulate Matter 10	PM_{10}	A01 Part 1; A01 Part 5; A05 Part 1; A07 Part 2; A08 Part 1	PA1, PA2, PM1, PM2
Total Volatile Organic Compounds	TVOC	A01 Part 2; A01 Part 5; A08 Part 1	PA3, PA4, PM1, PM2
Carbon Monoxide	CO	A01 Part 3; A01 Part 5; A05 Part 3; A08 Part 1	PA5, PA6, PM1, PM2
Ozone	O_3	A01 Part 3; A01 Part 5; A08 Part 1	PA5, PA6, PM1, PM2
Radon	Rn	A01 Part 4; A01 Part 5	PA9
Carbon Dioxide	CO_2	A03 Part 1; A06 Part 1; A08 Part 1	PA7, PA8, PM2
Formaldehyde	HCOH	A01 Part 5; A08 Part 1	PM1, PM2
Nitrogen Dioxide	NO_2	A05 Part 3; A08 Part 1	PA6, PM2
Temperature (dry-bulb)	T_{db}	A07 Part 2; T01 Part 1; T01 Part 2; T06 Part 1	PT1, PM4, PM5
Relative Humidity	RH	A07 Part 2; T01 Part 1; T01 Part 2; T06 Part 1; T07 Part 1	PT1, PT2, PM4, PM5

Monitor Placement

- Installation Location Options:
    - Monitors are installed on a wall (vertically), at a height of 1.1-1.7 m [3.6-5.6 ft] above the finished floor.
    - Monitors are installed on a ceiling (horizontally). This placement option is only applicable in spaces, 1) with ceilings are no greater than 3.7 m [12 ft] above the finished floor, 2) that do not utilize displacement ventilation, and 3) there is evidence that the air is evenly mixed. Evidence for evenly mixed air within a

space is submitted in the sensor data package as a Letter of Assurance from an Engineer confirming that a space meets requirements of a ventilation guideline listed in A03: Ventilation Design Part 1: Ensure Adequate Ventilation. Monitors utilized for this option must be designed to operate in a ceiling-mounted orientation.

- Monitors must be at least 1 m [3.3 ft] away from: doors, windows, air supply/exhaust outlets, air purifiers, or other potential influences (e.g., humidifiers, cleaning supplies, printers and photocopiers). To the extent possible, sampling points should be at least 5 m [16.4 ft] from exterior doors.
- Additionally, monitors measuring temperature and relative humidity must be at least 1 m [3.3 ft] away from: direct sunlight, mechanical system supply outlets, fans, heaters or any other significant source of heat or cold.

Monitor Density

- All parameters except radon:
    - Projects with occupiable space of < 3250 m^2: 1 monitor per 325 m^2 [3,500 ft^2] in occupiable spaces (minimum 2)
    - Projects with occupiable space of 3250-25,000 m^2: 1 monitor per 500 m^2 [5,400 ft^2] in occupiable spaces (minimum 10)
    - Projects with occupiable space of > 25,000 m^2: 1 monitor per 1000 m^2 [10,800 ft^2] in occupiable spaces (minimum 50)
- Radon:
    - 1 monitor per 2,300 m^2 [25,000 ft^2] of regularly occupied space at or below grade
- For WELL Core projects, to calculate number of monitors, use the area of the space(s) described in the WELL Core Guidance (e.g., for features that apply to non-leased space, use only the area of non-leased space).
- Monitors must be distributed throughout the project and to the extent possible, representative of all HVAC zones, faces of a building, and regularly occupied spaces (e.g., open office areas, private offices, conference rooms and classrooms).
- For projects with multiple floors, monitors must be distributed across different floors, including the lowest and highest regularly occupied floor (excluding floors with only leased space in WELL Core and Core & Shell projects).
- Multifamily Residential projects may only utilize continuous monitoring pathways in non-dwelling unit spaces—dwelling units must meet performance requirements through methods described in the *Performance Testing Protocols for WELL* section. To determine the monitor density for all other non-dwelling unit spaces, follow monitor density rate for the total area of the non-dwelling unit spaces only.
- For projects containing large open spaces (e.g., gyms, ball rooms, etc.), one monitor is sufficient for an area of up to 2,500 m^2 [27,000 ft^2] if there is evidence that the air is evenly mixed and contaminant sources are uniform (e.g., testing and balancing report indicating ventilation rate is even throughout the space, IAQ report indicating ventilation rate and contaminant levels are even throughout a space). Projects may submit an AAP prior to documentation review to verify which spaces are eligible to utilize the alternative monitor density rate.

Hardware Requirements

- Measurements are taken at intervals not larger than 1 hour for radon and not larger than 15 minutes for other parameters. Sensors which report more frequently (e.g., 1 minute, 5 minutes) may report at the greater frequency or average (mean) their results within each 15-minute interval. Radon sensors that can only provide output hourly measurements should be reported in intervals not larger than 15 minutes until a newer measurement is provided by the sensor system.
- Calibration:
    - All sensors measuring air quality parameters are recalibrated or replaced annually, and projects submit documentation attesting to their calibration or replacement annually through the WELL digital platform.
    - All sensors measuring thermal comfort parameters are recalibrated or replaced every three years, and projects submit documentation attesting to their calibration or replacement every three years through the WELL digital platform.
    - Note: field calibrations using a reference sensor are acceptable provided that the procedure allows the sensors to perform within manufacturer's listed specifications. The calibration period must capture a sufficient range and concentration of contaminant—either using known span gases or exposure to ambient pollution—to accurately perform adjustments.
- Sensors must provide continuous measurements during occupied hours; missing measurements and data loss will be interpreted as a threshold/range exceedance for that time period when calculating compliance.
    - If sensors are returned to manufacturers for calibration, up to one continuous month of sensor data may be excluded at no penalty to account for this. Project team should submit documentation which clearly documents the dates the sensor is away for calibration
- *Informative Note: continuous monitors connected to a permanent power source reduces potential monitor downtime attributed to power loss.*
- Table 4 provides sensor technical specification requirements. Alternatively, continuous monitors that are RESET accredited Grade B or above can be utilized for features and parts that can be met with continuous monitors. RESET accredited monitors utilized for WELL projects must still meet the calibration and measurement interval and reporting frequencies outlined in the Performance Verification Guidebook.

Table 4: Sensor Technical Specification Requirements

Parameter		Unit	Sensor Type	Range	Accuracy	Resolution	Parameter-specific Sensor Requirements
Particulate Matter 2.5	$PM_{2.5}$	$\mu g/m^3$	Optical/Laser particle counter (light scattering)	1-1000 $\mu g/m^3$	± 5 $\mu g/m^3$ + 20 % at 1-100 $\mu g/m^3$	1 $\mu g/m^3$	Adjustable particle density (K-factor) to accommodate project/region specific particulate profile
Particulate Matter 10	PM_{10}	$\mu g/m^3$					
Total Volatile Organic Compounds	TVOC	ppb or $\mu g/m^3$	Electrochemical, metal oxide semiconductor	1-2000 $\mu g/m^3$	± 20 $\mu g/m^3$ + 15% at 1-500 $\mu g/m^3$	1 $\mu g/m^3$	Calibration gas: ethanol Target gas profile (ppb=$\mu g/m^3$ conversion factor under STP): 22 VOC mixed per Molhav et al.* (1 ppb = 4.57 $\mu g/m^3$) OR to project-specific VOC profile
Carbon Monoxide	CO	ppm or mg/m^3	Electrochemical OR metal oxide semiconductor	0.1-25 ppm	± 1 ppm at 0-10 ppm	0.1 ppm	--
Ozone	O_3	ppb or mg/m^3	Electrochemical	10-500 ppb	± 10 ppb at 0-100 ppb	5 ppb	--
Radon	Rn	pCi/L or Bq/m^3	Alpha track detector (photodiode)	0.1-500 pCi/L	± 5 % at 0.1-5 pCi/L	0.1 pCi/L	--
Carbon Dioxide	CO_2	ppm	Non-dispersive infrared	400-5000 ppm	± 50 ppm + 5 % at 500-2000 ppm	1 ppm	--
Formaldehyde (A08 only)	HCOH	ppb or $\mu g/m^3$	Electrochemical OR metal oxide semiconductor	20-1000 ppb	± 20 ppb at 0-100 ppb	1 ppb	--
Nitrogen Dioxide	NO_2	ppb or µg/m3	Electrochemical OR metal oxide semiconductor	5-500 ppb	± 20 ppb at 0-100 ppb	1 ppb	--
Temperature (dry-bulb)	T_{db}	C° or F°	Metal oxide semiconductor	10-40 °C [50-100 °F]	± 0.5 °C [± 0.9 °F]	0.5 °C [±0.9 °F]	--
Relative Humidity	RH	%	Metal oxide semiconductor	5-95 %	± 5 % at 10-90 %	1%	--

Notes:
- Continuous monitoring sensor requirements may differ from device requirements specified in the Performance Testing Protocols for WELL
- Continuous monitors utilizing sensor types not listed in Table 4 are encouraged to submit an Alternative Adherence Path that includes 1) technical specifications listed in Table 4 and 2) evidence indicating the alternative sensor technology provides performance that is similar or exceeds approved sensor technologies.

* Mølhave, L., Clausen, G., Berglund, B., De Ceaurriz, J., Kettrup, A., Lindvall, T., Maroni, M., Pickering, A.C., Risse, U., Rothweiler, H., Seifert, B. and Younes, M. (1997), Total Volatile Organic Compounds (TVOC) in Indoor Air Quality Investigations. Indoor Air, 7: 225-240. https://doi.org/10.1111/j.1600-0668.1997.00002.x

Sensor Data: Submission and Reporting Requirements

Projects that utilize continuous monitor measurements for performance verification must submit data for performance review, which includes the following documents:

- Monitor Master List: a list of all continuous monitors and static parameters for a project. The following data are provided for each monitor (refer to sensor data file template):
    - WELL Project ID
    - Project Name
    - Project Location
    - Local Time Zone
    - Device ID
    - File Name
    - Device Location #
    - Device Location Name
    - Installation Date
    - Installation Height
    - Sensor(s) Type
    - Sensor(s) Range
    - Sensor(s) Accuracy
    - Sensor(s) Calibration Date
    - Sensor(s) Calibration Validity
    - Correction factors ($PM_{2.5}$, PM_{10}, TVOC sensors only)
- Sensor Data File: measurements are taken intervals not larger than 15 minutes—devices which report more frequently (e.g., 1 minute, 5 minutes) may report at the greater frequency or average (mean) their results within each 15-minute interval. Radon sensors that can only provide output hourly measurements shall be reported in intervals not larger than 15 minutes until a newer measurement is provided by the sensor. The following values are provided for each continuous measurement recording (refer to sensor data file template):
    - Timestamp.
    - Currently Occupied: whether that monitor location is typically occupied during that time period.
    - Measurement Data:
        - Corrected Measurement Data: expressed in units consistent thresholds units listed in WELL v2 or WELL Ratings.
        - Raw Measurement Data: the raw value provided by a sensor, prior to the application of calibration (e.g., gain, offset, user factors, etc.) or correction adjustments to the data. This field only needs to be populated if the sensor system applies adjustments to raw values.
- An annotated floor plan with the project size and monitor locations.
- Photographs of each monitor location including, when possible, the background of the space to provide context (e.g., height, away from potential influences).

- Data are submitted annually through the WELL digital platform in one the following formats: CSV or Excel file format. Refer to templates for specific guidance.

Calculating Compliance

- Air and Thermal Comfort parameters: determined based on each sensor's data meeting the threshold listed in the feature for at least 90% of regularly occupied hours.
- For initial award, at least one calendar month of data is required; for recertification/renewal, the time period since the previous award date is considered.

Recertification

WELL Certification is valid for three years and WELL Ratings are valid for one year, at which point projects must undergo recertification or renewal to maintain their certified or rated status. During this process, the project is re-evaluated to verify that it continues to perform as designed. The requirements for retesting performance verified features depend on the extent of alterations made to the project since initial certification.

Reduced Sample Points

This section applies to on-site tested metrics only. For measurements generated from permanently installed continuous monitors, data from all sensors will be considered, regardless of whether there have been any changes to the project.

If a WELL Certified project has not undergone applicable alterations (see *Project Alterations*), it is eligible for a reduced amount of testing. Table 5 lists the level of retesting that is required for each of the parameters in this guidebook at recertification for a project without applicable alterations, as follows:

- Full: the parameter is assessed in the same manner as for initial WELL certification.
- Reduced: the parameter is assessed at half the number of test locations as required for initial certification (round down, minimum 1).
- None: no performance testing is required.

The reduction in sampling is only available for features previously awarded at WELL Certification. Projects targeting features in addition to those achieved at the project's initial certification do not qualify for reduced sampling points for these additional features.

WELL Performance Testing Agents are encouraged to vary the locations of sampling points each time they conduct testing for recertification.

Project Alterations

As part of recertification, projects will fill out a form to document any changes that have taken place since its previous (re)certification. Applicable alterations include changes made to:

- Interior design: doors, appliances, furniture, finishes, layout and lighting.
- Exterior design: building grounds, exterior lighting.
- Mechanical systems: heating, ventilation and air conditioning.
- Structure: building envelope and fenestration.
- Plumbing systems: water distribution and treatment.

Table 5 provides details on which types of project alterations impact the number of test locations. Projects that have made changes to at least 10% of the scope covered in each category are considered to have applicable alterations. For example, a project which replaced 50% of its lights and one of its 25 workstations would undergo full retesting for visual lighting and circadian lighting. However, the changes to furniture would be small

enough that it is still eligible for reduced retesting for VOCs and formaldehyde and no retesting for reverberation time.

Parameters are reassessed with a preference given to spaces located within or near the modifications that have occurred.

Table 5: Eligibility for Reduced Sampling Points Based on Extent of Alterations

Concept	Parameter	Extent of alterations															Level of testing	
		Interior Design						Exterior Design		Mechanical System			Overall Structure		Plumbing System		No relevant alteration	With relevant alteration
		Doors	Appliances	Furniture	Finishes	Layout	Lighting	Building Grounds	Lighting	Heating	Ventilating	Air Conditioning	Building Envelope	Fenestration	Water Distribution	Treatment		
Air	PM2.5 and PM10										✓		✓				Reduced	Full
	Carbon Monoxide										✓		✓				Reduced	Full
	VOCs			✓	✓						✓						Reduced	Full
	Formaldehyde			✓	✓						✓						Reduced	Full
	Ozone										✓		✓				Reduced	Full
	Radon												✓				None	Full
Water	Turbidity																Full	Full
	Coliforms																Full	Full
	Disinfectants																Full	Full
	Lab-Based Contaminants														✓	✓	Reduced	Full
Light	Visual Lighting			✓	✓	✓	✓		✓								None	Full
	Circadian Lighting			✓	✓	✓	✓										None	Full
Thermal Comfort	Dry-bulb Temperature									✓	✓	✓	✓	✓			Reduced	Full
	Mean Radiant Temperature									✓	✓	✓	✓	✓			Reduced	Full
	Relative Humidity									✓	✓	✓	✓	✓			Reduced	Full
Sound	Exterior Noise Intrusion							✓		✓	✓	✓	✓	✓			None	Full
	Disruptive Noise Limitation							✓		✓	✓	✓	✓	✓			None	Full
	Internally Generated Noise		✓			✓				✓	✓	✓	✓	✓	✓		None	Full
	Background Noise Level		✓			✓		✓		✓	✓	✓	✓	✓	✓		Reduced	Full
	Reverberation Time			✓	✓												None	Full
	Sound Insulation	✓								✓	✓	✓					None	Full
	Sound Masking				✓	✓				✓	✓	✓					None	Full

The categories of alterations are shown in the columns and the parameters are listed in the rows. A checkmark in a cell indicates that a project with this type of alteration must undergo "Full" testing at recertification, instead of "Reduced" or "None".

Annually Aggregated Data

This section applies to on-site tested metrics only. For measurements generated from permanently installed continuous monitors, data from all sensors will be considered,

For select performance verified features in WELL v2 and WELL v2 pilot (as identified in the Note of that feature in the digital standard), WELL Certified projects have the option to aggregate annual data collected in accordance with the Performance Verification Guidebook for recertification. To be eligible for this pathway, the project must use a WELL Performance Testing Agent for all annual testing for the relevant feature(s). Note that even if a project has used a WELL Performance Testing Agent to collect the annual data, they are not required to aggregate their data and may still elect to use results from recertification testing after three years.

As with testing at recertification, WELL Performance Testing Agents are encouraged to vary the location of sampling points each year if there are multiple locations that meet the requirements in the Test Locations & Conditions sections.

The number of locations for annual tests is based on the guidance in the *Reduced Sample Points* section. For the purposes of determining eligibility for reduction of sampling points, consider alterations to the project only in the 12 months prior to the annual test. Annual data is aggregated, including years with and without reduced sampling points.

Air

For each pollutant listed in A01 Parts 1, 2 and 3, average the values submitted to the WELL Reviewer for Part 5. Compare this average against the thresholds listed in the feature plus the applicable tolerances mentioned in the *Reporting & Compliance* sections.

For example, take the following $PM_{2.5}$ concentrations from a sample project which requires two sampling locations for A01.

	Annual $PM_{2.5}$ Levels ($\mu g/m^3$)			
Test location	Year 1	Year 2	Year 3	Average
Open office	15	-	15	16
Enclosed office	-	20	19	
Conference room #1	-	14	-	
Conference room #2	13	-	-	

The average of 16 $\mu g/m^3$ is less than the threshold of 15 $\mu g/m^3$ + the 20% tolerance described in this guidebook and meets feature requirements.

Water

For each pollutant listed in W01 Parts 1 and 2 and W02 Parts 1-6, average the values submitted to the WELL Reviewer for Part 5. Compare this average against the thresholds listed in the feature.

Thermal Comfort

For T01, average the absolute values (i.e., positive value) of the PMV calculated from each semiannual measurement. Compare this average against the upper and lower PMV thresholds listed in the feature.

	Annual PMV Levels			
Test location	Year 1	Year 2	Year 3	Average
Open office	-	0.4	-	0.33
Enclosed office	0.2	-	0.1	
Conference room #1	$\|-0.5\| = 0.5$	$\|-0.7\| = 0.7$	-	
Conference room #2	-	-	$\|-0.1\| = 0.1$	

The average of the absolute values in this example is 0.33 and hence complies with the ± 0.5 requirements of T01.

Glossary

Configuration: With water, a configuration refers to the water treatment method used if water is treated at all. For example, a bathroom sink and kitchen sink that both use point-of-use sediment filters are of the same configuration; conversely, a drinking water fountain with a point-of-use filter and another drinking water fountain that uses base building water with no further treatment are of different configurations. Sinks and dispensers in different buildings are considered different configurations.

Continuous Monitors: Permanently installed hardware system that includes sensor technology to measure environmental conditions and a mechanism to store data, either locally or through cloud/network storage. To measure multiple parameters, continuous monitors may include more than one sensor.

Leased Spaces: All areas within the project boundary that are leased or owned by tenants.

Non-leased Spaces: All areas within the project boundary that are not considered leased space.

On-going Monitoring: Activities required in certain features of WELL wherein projects engage in on-going measurements of environmental parameters.

Parameter: A particular physical condition that is measured (e.g., dry-bulb temperature, formaldehyde concentration).

Performance Testing: On-site component of the WELL process wherein an independent agent, trained in the testing protocols of the WELL Performance Verification Guidebook, conducts tests on environmental parameters, collects samples, submits them to labs and analyzes data.

Regularly occupied space: Area within the project boundary where a particular individual normally spends at least one continuous hour or, cumulatively, at least two hours per day, such as an office, conference room, bedroom or classroom.

Sensor: A device—often integrated into continuous monitoring systems—which measures or detects a physical stimulus (e.g., carbon dioxide, heat, sound) and transmits the information to downstream hardware.

WELL Performance Testing Agent: An agent who is trained and qualified to conduct performance testing for WELL. This may refer to GBCI agents or individuals from other organizations who are trained and approved by GBCI.

Performance Review: Review is carried out by a WELL Reviewer of performance testing data to verify that all testing and analysis is accurate and conducted in accordance with the WELL Performance Verification Guidebook.

WELL Reviewer: An agent approved by IWBI who reviews and approves all documentation and performance test results for WELL. WELL Reviewers are trained to understand proper adherence to testing protocols for evaluating WELL performance criteria and confirm that all design, construction, operational and policy documentation submitted by the project accurately attest to achievement of WELL features.

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